PHYSIOGRAPHIC NOTES.

BY

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PHYSICAL GEOGRAPHY OF TEXAS.—Folio 3, of the Topographic Atlas of the United States, just published, is devoted to a description and discussion of the Physical Geography of the Texas Region by Robert T. Hill. It is a publication of decided importance to all students of the new physical geography, and ought in addition to be of great value in the schools of Texas and elsewhere. After a general description of the State there is a discussion of the relief, with special reference to the relation between the surface features and the geological formations; and Mr. Hill's treatment shows that this relation is decidedly interesting. While the treatment of the mountainous sections is excellent, it is natural that in this State, so typically a region of plains, the consideration of features connected with plains is most fully treated. There is, so far as I know, no other discussion of plains so elaborate as this. The State supplies types of a great variety of plains, and these are fully described, interpreted and classified. In connection with the description Mr. Hill has found it desirable to introduce several new terms, a number of which are borrowed from the Spanish.

Following the description of mountains and plains there is a briefer discussion of the rivers, in which many of the peculiar features of the Texas drainage are interpreted. This is followed by a general treatment of the climatic features, illustrated by maps, and the text closes with a brief statement of the economic geology and the main facts concerning the distribution of population.

The paper is more than a mere contribution to local physiography. Its breadth of treatment warrants us in ranking it as one of the notable contributions to general physiography ; and its value is greatly increased by the splendid illustrations printed upon sheets at the close of the Folio. These include a number of beautiful and well-selected half-tones of some of the more typical features which are capable of illustration by photograph ; and in addition to these are many map illustrations of features which are too large to be shown by half-tones. These maps are carefully selected from the topographic sheets of the United States Geological Survey. In no case is the entire sheet included, but merely those portions which

illustrate the types. They therefore stand out as striking representations of the forms. The last illustration is a large folded contour map of the State, based to a considerable extent on Mr. Hill's own intimate knowledge of the surface features of Texas.

There is but one feature of the Folio which seems unfortunate, and that is its immense and unwieldy size. While this objection applies to all Folios of the Survey, it may be urged with greater force against this one, since it is not only unnecessary, but seriously interferes with its use in school work. The text is printed in four parallel columns on each page, making its study difficult in the extreme. Since the paper is so important a contribution, it is to be hoped that it will be found possible to publish it in book form. The larger map sections could be easily reproduced in a smaller size, making them full-page illustrations, and the map of Texas could be included as a folded map in a pocket.

The Cascade Mountains of Northern Washington.—The work which Professor I. C. Russell has been engaged upon during the last few years in the Cascades of northern Washington appears as a preliminary paper in the Twentieth Annual Report of the United States Geological Survey (Part II, pp. 83–210). In this paper Professor Russell makes some important contributions to the physiography of that region.

The prevailing westerly winds cause a warm, humid climate and heavy rainfall on the western side, where the snowfall is light near the sea-level, but heavy in the mountains. The fogs, clouds and rain of this western slope are in striking contrast to the sunny, arid, eastern slopes. In consequence, while the eastern Cascades are largely without trees, the western slope is clothed in a dense forest of giant trees. Professor Russell's description of this forest is the best that I have seen. He shows, too, that the difference of climate, so clearly defined at present, was also present during the Glacial Period. The existing glaciers of this part of the Cascades are, for the most part, on the rainy western side of the divide, and in the Glacial Period the glaciers on the western slope of the mountains were far more extensive and of greater thickness than those that descended the deeply-cut valleys on the east side. That this difference in climate is even more ancient than the Glacial Period is indicated by the fact that the west-flowing streams show evidence of greater maturity than the east-flowing streams. While this is due largely to differences in rainfall, it is, of course, to be explained in part by the fact that the west-flowing streams have shorter and more direct slopes to the sea.

This portion of the Cascade Mountains is a complex of wild and exceedingly rugged ranges, occupying a tract from one hundred to one hundred and twenty-five miles in width. The general elevation of these ridges is about 7,500 feet, giving the appearance of a plateau as viewed along the crests; but here and there peaks and groups of peaks rise to a still greater elevation. Among the peaks are some volcanic mountains, only one of which, however—Glacier Peak—is situated in the part of the Cascades which Russell has studied. The rocks of the mountains are metamorphic, igneous and sedimentary, varying, therefore, in power of resistance to the weather. They are, moreover, complexly folded, with the folds having north and south axes in the main, but with some folds and faults diverging at a high angle from the main trend of the Cascades. The age of the rocks varies from pre-Cretaceous to Tertiary, the older rocks being so metamorphosed that their exact geological age is unknown.

In consequence of the uniformity in elevation of the average crest of the ridges, taken in connection with the complexity of the texture and altitude, Russell concludes that

> The Cascade Mountains, as we now know them, seem to have been carved from an upraised peneplain.

His interpretation of the present form is that an older mountain system, long eroded, was ultimately reduced to the condition of a peneplain, then elevated bodily at least 7,500 feet, and later deeply dissected until the present rugged topography was evolved. To the present writer this interpretation of the topography seems to rest upon very unconvincing evidence. It is this sort of so-called peneplain against which I have protested in a recent paper. Without a more complete discussion of other explanations, there are a number of physiographers who will look with scepticism upon this hypothesis as applying to the interpretation of the rugged Cascades.

In the dissection of the Cascade Mountains there have been a number of interesting stream changes, which Russell discusses in his treatment of the river valleys. He points out that the greater part of the task of dissecting the land has been performed by running water, but that glaciers have done something to modify the contours of the valleys. These glaciers, now represented by mere remnants of a minute kind in the higher valleys, formerly flowed outward both to the east and west as true Alpine glaciers of immense size. Both the ancient and the existing glaciers are fully described in the text, and in connection with this description numerous instances are pointed out in which valleys have been modified by ice

action through scouring, deepening and filling. A number of examples of rock basins are mentioned, and an excellent half-tone illustration of one of these is presented. There is a full description of the beautiful and interesting Lake Chelan, previously described by Gannett.

As previously stated, the ancient glaciers on the western side were the most extensively developed, and the ice upon that side was so thick

that when the glacial conditions were at their maximum a general ice-sheet was formed, which buried some of the most prominent ridges.

These thick glaciers, descending to the plain at the western base of the mountains,

expanded and united at their lower extremities and assisted in forming a large piedmont glacier which occupied the Puget Sound Basin. This piedmont glacier had two stages of broad expansion, separated by an interglacial stage, during which thick gravel deposits, together with layers of peat, were spread out on top of a basement layer of till.

It is noteworthy that it was Russell who described the first existing instance of a piedmont glacier, and that he, too, has given us this clear evidence of a much larger ancient example of a similar ice-sheet. Another feature connected with glacial deposit and post-glacial erosion is the deep filling of gravel and sand, in general, several hundred feet in depth, in the valleys of northern and eastern Washington. It is the excavation of these gravels in post-glacial times that has given rise to the beautiful terraces which border these streams. Russell presents clear evidence that the formation of these terraces has been due in no sense to a tilting of the land, but merely to increased power of erosion, due to the decreasing load of sediment resulting from the disappearance of the glaciers. The paper closes with a detailed discussion of the influence of avalanches and land-slides upon the topography of this region, followed by a very brief treatment of the economic deposits.